What is claimed is:

1. A process for growing a single crystal silicon ingot in which the ingot comprises a central axis, a seed-cone, a tail-end and a constant diameter portion between the seed-cone and the end-cone having a lateral surface, a radius extending from the central axis to the lateral surface, the ingot being grown from a silicon melt and then cooled from the solidification temperature in accordance with the Czochralski method, the process comprising:

controlling (i) a growth velocity, v, (ii) an average axial temperature gradient, G_0, during the growth of the constant diameter portion of the crystal over the temperature range from solidification to a temperature of no less than about 1325°C, and (iii) the cooling rate of the crystal from the solidification temperature to about 750°C, to cause the formation of a segment wherein an interstitial-dominated axially symmetric region which is substantially free of type A agglomerated defects extends radially inward from the lateral surface, wherein a vacancy-dominated axially symmetric region extends radially inward from the interstitial-dominated region, and further wherein a wafer obtain from said segment, upon being subjected to a subsequent oxidation treatment, has an oxidation induced stacking fault concentration of less than about $50/cm^2$.

2. The process of claim 1 wherein the cooling rate is controlled over a first temperature range from the solidification temperature to a temperature of about 1,050°C, to cause the formation of the interstitial-dominated, axially symmetric region, and over a second

temperature range from about 1,050°C to a temperature greater than about 750°C.

3. The process of claim 2 wherein the interstitial-dominated, axially symmetric region is also substantially free of B type agglomerated defects.

4. The process of claim 2 wherein the crystal has a nominal diameter of about 150 mm and is cooled from the solidification temperature to a temperature of at least about 1,050°C over a period of at least about 10 hours.

5. The process of claim 2 wherein the crystal has a nominal diameter of about 150 mm and is cooled from the solidification temperature to a temperature of at least about 1,050°C over a period of at least about 15 hours.

6. The process of claim 2 wherein the crystal has a nominal diameter of about 200 mm and is cooled from the solidification temperature to a temperature of at least about 1,050°C over a period of at least about 10 hours.

7. The process of claim 2 wherein the crystal has a nominal diameter of about 200 mm and is cooled from the solidification temperature to a temperature of at least about 1,050°C over a period of at least about 20 hours.

8. The process of claim 2 wherein the crystal has a nominal diameter of greater than about 200 mm and is cooled from the solidification temperature to a temperature of at least about 1,050°C over a period of at least about 40 hours.

9. The process of claim 2 wherein the crystal has a nominal diameter of greater than 200 mm and is cooled from the solidification temperature to a temperature of at least about 1,050 °C over a period of at least about 60 hours.

10. The process of claim 2 wherein the cooling rate is controlled from about 1,050°C to about 750°C, such that a wafer obtain from said segment, upon being subjected to a subsequent oxidation treatment, has an oxidation induced stacking fault concentration of less than about $40/cm^2$.

11. The process of claim 10 wherein the average oxygen content of the wafer is within the range of about 11 to about 14.5 PPMA.

12. The process of claim 11 wherein the average cooling rate between about 1,050°C and about 750°C is at least about 1°C/minute, 1.5°C/minute or 2°C/minute.

13. The process of claim 10 wherein the average oxygen content of the wafer is within the range of about 14.5 to about 18 PPMA.

14. The process of claim 13 wherein the average cooling rate between about 1,050°C and about 750°C is at least about 2°C/minute, 2.5°C/minute or 3°C/minute.

15. The process of claim 1 wherein the crystal has a nominal diameter of at least about 300 mm.

16. The process of claim 1 wherein the interstitial-dominated, axially symmetric region has a radial width of about 20% of the length of the radius of the ingot.

17. The process of claim 16 wherein the length of the segment is at least about 40% of the length of the constant diameter portion of the ingot.

18. The process of claim 16 wherein the length of the segment is at least about 80% of the length of the constant diameter portion of the ingot.

19. The process of claim 1 wherein the interstitial-dominated, axially symmetric region has a radial width of about 60% of the length of the radius of the ingot.

20. The process of claim 19 wherein the length of the segment is at least about 40% of the length of the constant diameter portion of the ingot.

21. The process of claim 19 wherein the length of the segment is at least about 80% of the length of the constant diameter portion of the ingot.

22. The process of claim 1 wherein the oxidation induced stacking fault concentration of a wafer obtained from the segment is less than about 20/cm^2.

23. The process of claim 1 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 25.

24. The process of claim 1 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 10.

25. The process of claim 1 wherein the average oxygen content of the wafer is at least about 12 PPMA.

26. The process of claim 1 wherein the average oxygen content of the wafer is at least about 14 PPMA.

27. The process of claim 1 wherein the average oxygen content of the wafer is at least about 16 PPMA.

28. The process of claim 1 wherein the average oxygen content of the wafer is at least about 18 PPMA.

29. A process for growing a single crystal silicon ingot in which the ingot comprises a central axis, a seed-cone, a tail-end and a constant diameter portion between the seed-cone and the end-cone, the constant diameter portion having a lateral surface and a radius extending from the central axis to the lateral surface, the ingot being grown from a silicon melt in accordance with the Czochralski method, the process comprising:

cooling the ingot from the temperature of solidification to a temperature of less than about 750°C and, as part of said cooling step, quench cooling a segment of the constant diameter portion of the ingot through a temperature of nucleation for the agglomeration of silicon self-interstitials and oxygen precipitates, to obtain in said segment an interstitial-dominated, axially symmetric region extending radially inward from the lateral surface

and a vacancy-dominated, axially symmetric region extending radially inward from said interstitial-dominated region, wherein said interstitial-dominated region is substantially free of type A agglomerated defects, and further wherein a wafer obtain from said segment, upon being subjected to a subsequent oxidation treatment, has an oxidation induced stacking fault concentration of less than about $50/cm^2$.

30. The process of claim 29 wherein the interstitial-dominated region has a width of about 20% of the radius of the constant diameter portion.

31. The process of claim 30 wherein the segment has an axial length of at least 40% of the axial length of the constant diameter portion.

32. The process of claim 30 wherein the segment has an axial length of at least 80% of the axial length of the constant diameter portion.

33. The process of claim 29 wherein the interstitial-dominated region has a width of about 40% of the radius of the constant diameter portion.

34. The process of claim 33 wherein the segment has an axial length of at least 40% of the axial length of the constant diameter portion.

35. The process of claim 33 wherein the segment has an axial length of at least 80% of the axial length of the constant diameter portion.

36. The process of claim 29 wherein the ingot segment is quench cooled through the range of temperatures from 1,200 °C to about 1,000 °C.

37. The process claim 36 wherein the region is quench cooled at a rate of at least 5°C/min.

38. The process claim 36 wherein the region is quench cooled at a rate of at least 10°C/min.

39. The process of claim 29 wherein the ingot is quench cooled through the range of temperatures from about 850°C to about 1,050°C.

40. The process claim 39 wherein the region is quench cooled at a rate of at least 5°C/min.

41. The process claim 39 wherein the region is quench cooled at a rate of at least 10°C/min.

42. The process of claim 29 wherein after said cooling step the interstitial-dominated, axially symmetric region contains B-defects but not A-defects.

43. The process of claim 29 wherein the constant diameter portion has a radius of at least about 100 mm.

44. The process of claim 29 wherein the constant diameter portion has a radius of at least about 150 mm.

45. The process of claim 29 wherein the average oxygen content of the segment is within the range of about 11 to about 14.5 PPMA.

46. The process of claim 29 wherein the average oxygen content of the segment is within the range of about 14.5 to about 18 PPMA.

47. The process of claim 29 wherein the oxidation induced stacking fault concentration of a wafer obtained from the segment is less than about 40/cm^2.

48. The process of claim 29 wherein the oxidation induced stacking fault concentration of a wafer obtained from the segment is less than about 20/cm^2.

49. The process of claim 29 wherein the oxidation induced stacking fault concentration of a wafer obtained from the segment is less than about 10/cm^2.

50. The process of claim 29 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 25.

51. The process of claim 29 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 10.

52. A single crystal silicon wafer having a central axis, a front side and a back side which are generally perpendicular to the axis, a circumferential edge, and a

radius extending from the central axis to the circumferential edge of the wafer, the wafer comprising:

an interstitial-dominated, axially symmetric region extending radially inward from the circumferential edge which is substantially free of A type agglomerated interstitial defects; and,

a vacancy-dominated, axially symmetric region extending radially inward from the interstitial-dominated region wherein, upon being subjected to an oxidation treatment, an oxidation induced stacking fault concentration is less than about $50/cm^2$.

53. The wafer of claim 52 wherein the interstitial-dominated, axially symmetric region is also substantially free of B type agglomerated defects.

54. The wafer of claim 52 wherein the wafer has a radius of at least about 150 mm.

55. The wafer of claim 52 wherein the interstitial-dominated, axially symmetric region has a radial width of about 40% of the length of the radius of the ingot.

56. The wafer of claim 52 wherein the interstitial-dominated, axially symmetric region has a radial width of about 40% of the length of the radius of the ingot.

57. The wafer of claim 52 wherein the average oxygen content of the wafer is within the range of about 11 to about 14.5 PPMA.

58. The wafer of claim 52 wherein the average oxygen content of the wafer is within the range of about 14.5 to about 18 PPMA.

59. The wafer of claim 52 wherein the oxidation induced stacking fault concentration of the wafer is less than about $40/cm^2$.

60. The wafer of claim 52 wherein the oxidation induced stacking fault concentration of the wafer is less than about $20/cm^2$.

61. The wafer of claim 52 wherein the oxidation induced stacking fault concentration of the wafer is less than about $10/cm^2$.

62. The wafer of claim 52 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 25.

63. The wafer of claim 52 wherein the number of light point defects equal to or greater than about 0.12 microns in size on the wafer surface is less than about 10.

64. A crystal puller for producing a monocrystalline ingot, the crystal puller comprising:

a crucible for holding molten semiconductor source material;

a heater in thermal communication with the crucible for heating the crucible to a temperature sufficient to melt the semiconductor source material held by the crucible;

a pulling mechanism positioned above the crucible for pulling the ingot from the molten material held by the crucible;

a heat shield assembly disposed above the molten source material held by the crucible, the heat shield assembly having a central opening sized and shaped for surrounding the ingot as the ingot is pulled from the molten material, said heat shield assembly being generally interposed between the ingot and the crucible as the ingot is pulled upward from the source material within the crystal puller; and

a cooling system disposed in the crystal puller above the heat shield assembly for further cooling the ingot as the ingot is pulled upward within the crystal puller above the heat shield assembly, the cooling system having a central opening sized and shaped for surrounding the ingot as the ingot is pulled upward within the crystal puller.

65. A crystal puller as set forth in claim 64 wherein the cooling system has a bottom spaced axially above the top of the heat shield assembly a distance sufficient to permit viewing of the ingot through a view port in the crystal puller housing.

66. A crystal puller as set forth in claim 64 wherein the cooling system has a bottom spaced axially above the top of the heat shield assembly a distance sufficient to permit positioning of a feed tube there between and above the crucible to direct unmelted polycrystalline material into the crucible.

67. A crystal puller as set forth in claim 64 wherein the cooling system comprises a housing defining an interior

chamber and a cooling tube disposed in the chamber in close contact relationship with at least a portion of the housing to permit conductive heat transfer between the cooling tube and the housing, the cooling tube having an inlet in fluid communication with a source of cooling fluid for receiving cooling fluid therein and an outlet for exhausting cooling fluid from the cooling tube, the outlet of the cooling tube generally being within the interior chamber defined by the housing for exhausting cooling fluid from the cooling tube into the chamber.

68. A crystal puller as set forth in claim 67 wherein the cooling tube is of coil construction whereby turns of the cooling tube wind generally downward within the chamber, the cooling tube having an inlet disposed generally adjacent the top of the housing and an outlet disposed generally adjacent the bottom of the housing such that cooling fluid is received in the cooling tube generally adjacent the top of the housing and is directed downward through the cooling tube for exhaustion from the cooling tube into the interior chamber of the housing generally adjacent the bottom of the housing, the close contact relationship between the cooling tube and the housing generally defining a return flow path for cooling fluid exhausted from the cooling tube whereby cooling fluid exhausted from the cooling tube into the interior chamber is directed to flow upward within the chamber toward the top of the housing.

69. A crystal puller as set forth in claim 68 wherein the cooling system further comprises a baffle connected to the bottom of the housing within the interior chamber of the housing, the baffle being positioned generally adjacent the

outlet of the cooling tube for directing cooling fluid exhausted from the outlet of the cooling tube to flow upward within the chamber along the return flow path in a direction opposite the direction of flow of cooling fluid winding downward through the cooling tube.

70. A crystal puller as set forth in claim 69 wherein the housing includes an opening providing fluid communication between the inlet of the cooling tube and said source of cooling fluid and for exhausting cooling fluid in the chamber from the cooling system housing.

71. A crystal puller as set forth in claim 68 wherein the cooling system further comprises an adapter ring for mounting the cooling system on the crystal puller, the adapter ring comprising a flange member extending radially outward relative to the cooling system housing and being adapted for securing the cooling system to the crystal puller, said flange member being in fluid communication with the source of cooling fluid and having an inlet port in fluid communication with the inlet of the cooling tube for receiving cooling fluid into the cooling system, said flange member further having an outlet port in fluid communication with the interior chamber of the housing for exhausting cooling fluid from the cooling system.

72. A crystal puller as set forth in claim 71 wherein the flange member further comprises a plenum in fluid communication with the interior chamber of the housing for receiving cooling fluid into the flange member to cool the flange member and to direct cooling fluid toward the outlet port for exhausting cooling fluid from the cooling system.